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Abstract of Paper. This paper advances a simple index designed to capture the relative ease of redressing poverty through redistributive taxation, and evaluates the Indian experience in the light of empirical evidence on poverty put together on the basis of considerations suggested by a prior theoretical line of enquiry.

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1.INTRODUCTION

In this note we explore some simple analytics of the arithmetic of curing poverty through the mechanism of redistribution. To this end, we develop a real-valued index which is intended to reflect the magnitude of effort required to eradicate poverty in a society through a scheme of progressive taxation. In deriving this index, we exploit certain leads in the poverty-measurement literature afforded by earlier work done by Sudhir Anand (1983). In particular, we draw on the conceptual trappings of Anand's 'redressal of poverty rule', and on a measure of poverty advanced by him which Amartya Sen (1981;p.190) characterizes as reflecting 'the relative burden of poverty of the nation compared with its aggregate income'. We present some poverty computations, relating to the theme of this paper,using Indian data. The note concludes with some comments on the findings from our empirical exercises.

2.PRELIMINARY FORMALITIES

x is a random variable denoting income, and is distributed over the interval $[0,\bar{x}]$. The density function of x is denoted by f(x), and the cumulative density function by F(x). The mean of the distribution is μ. $F_1(x)$ - the share in total income of units with incomes not exceeding x - is the first-moment distribution function of x (see Nanak Kakwani,1980). We have: $F(x) = \int_0^x f(y)dy$; $F_1(x) = (1/\mu)\int_0^x yf(y)dy$; $\lim_{x\to 0}F(x) = \lim_{x\to 0}F_1(x) = 0$; and $\lim_{x\to\bar{x}} F(x) = \lim_{x\to\bar{x}} F_1(x) = 1$. The poverty line, z, is a level

of income such that units with incomes less than z are certified as being absolutely impoverished. Throughout this note we shall assume that $\mu \geq z$. We shall let I stand for the interval $[0,z)$. Population size is normalized to unity. $F(z)$ is the proportion of the population in poverty, or the 'headcount ratio'. The average income of the poor is $\mu^p := (1/F(z))\int_I xf(x)dx$ $(=\{F_1(z)/F(z)\}\mu)$. The <u>aggregate poverty deficit</u> , which is the shortfall in the total income of the poor from the total income that would be needed to raise all the poor to the poverty line, will be denoted by D. It is clear that $D = F(z)(z-\mu^p)$. Now consider the ratio P, given by

$$P = D/\mu. \qquad ...(1)$$

P expresses the aggregate poverty deficit as a proportion of the total income of the community (note that since the population size has been normalized to unity, the total income of the community is also its mean income μ). The smaller the value of P, the greater is the potential capacity of the community to eradicate poverty through redistribution: the index P, advanced by Anand (1983), serves the purpose - as Sen (1981;p.190) puts it - of 'express[ing] the percentage of national income that would have to be devoted to transfers if poverty were to be wiped out by redistribution, and in this sense [P] reflects the <u>relative</u> burden of poverty of the nation compared with its aggregate income'.

3. A VARIANT OF THE INDEX P

We now address ourselves to a question which is related to, but somewhat different from, the question addressed by the index P. We ask: what is a rule of progressive taxation - starting from the richest unit and working one's way downward - which will yield up a sufficient cumulative transfer that will wipe out poverty? Analytically, the required taxation scheme bears a close resemblance to, and is a sort of mirror-reversal of, what Anand (1983), in a somewhat different context, has called 'the redressal

of poverty rule'(in this connection, see also Gangopadhyay and Subramanian, 1992). The underlying principle of the proposed taxation rule can be most easily understood if we imagine income to be discretely distributed. The content of the rule is as follows.

Suppose the richest person's income is taxed to the point where his income is equalized with the income of the next richest person: if the amount of tax collected is sufficient to bridge the aggregate poverty deficit D, there is nothing further that needs to be done. If not, we reduce the incomes of the richest and the next richest persons to the level of the third richest person's income: if the total revenue thus collected by way of tax is sufficient to bridge the deficit D, we stop the exercise; otherwsie, the incomes of the richest three individuals are reduced to the level of the fourth richest person's income ...and so on, until the total tax revenue collected is just enough to bridge the deficit D.

For the case of the continuous distribution, the proposed 'progressive redistributive taxation schedule' (PRT schedule, for short) can be formalized along the following lines. Let the level of income x^* be defined such that the following equation is satisfied:

$$\int_{x^*}^{\bar{x}} (x-x^*)f(x)dx=D. \quad ...(2)$$

Our proposed PRT schedule $<t^*(x)>_{x\in[0,\bar{x}]}$ is one which is equal almost everywhere on $[0,\bar{x}]$ to the schedule $<T^*(x)>$ given by

$$\left.\begin{aligned} T^*(x) &= 0 \ \forall x\in[0,x^*]; \\ &= x-x^* \ \forall x\in(x^*,\bar{x}], \end{aligned}\right\} \quad ...(3)$$

where x^* is as defined in (2).

Note from (3) that the PRT schedule requires the implementation of a sort of 'Rawlsian lexicographic maximin solution' - viz., a sequence of progressive and income-equalizing transfers, starting from the richest unit and working one's way downward, till one arrives at that marginal unit (with income x^*), at which the total sum of transfers is just equal to the aggregate poverty deficit: x^* is the <u>maximum</u> value which the income of the worst-off of the taxed units can assume. Notice also that the PRT schedule effects a 'rank preserving' transformation of incomes, in the following well-defined sense: $\forall x, x' \in [0, \bar{x}]: x \geq x' \longrightarrow x - t^*(x) \geq x' - t^*(x')$.

Next, letting I^* stand for the interval $[0, x^*)$, define the income level $\bar{x}^*$ as $\bar{x}^* := \sup\{x | x \in I^*\}$; and let φ^* stand for $1 - F(\bar{x}^*)$. If N ($:= \{1 - F_1(\bar{x}^*)\}\mu$) is the total income of the richest φ^* proportion of the population, let β be the ratio D/N: β measures the aggregate poverty deficit as a proportion of the total income of the richest φ^* proportion of the population. Now consider the two-dimensional vector $v = (\varphi^*, \beta)$: v conveys the information that if β per cent of the total income of the richest φ^* proportion of the population is taxed, then the tax revenue thus raised is sufficient to bridge the aggregate poverty deficit in the economy. One could attempt to compare the ease of eradicating poverty through redistributive taxation, across societies, in terms of the vector v. Thus, given any two societies 1 and 2 and corresponding vectors $v_1 = (\varphi_1^*, \beta_1)$ and $v_2 = (\varphi_2^*, \beta_2)$, we could say that 'it is at least as easy to eradicate poverty through redistribution in society 1 as in society 2' - written $v_1 \, Q \, v_2$ - if and only if $\varphi_1^* \leq \varphi_2^*$ and $\beta_1 \leq \beta_2$. (The asymmetric and symmetric components of Q - written $\bar{Q}$ and $\underline{Q}$ respectively - are defined as follows: $[\forall v_1, v_2: v_1 \, \bar{Q} \, v_2 \leftrightarrow v_1 \, Q \, v_2 \;\&\; \sim (v_2 \, Q \, v_1)]$, and $[\forall v_1, v_2: v_1 \, \underline{Q} \, v_2 \leftrightarrow v_1 \, Q \, v_2 \;\&\; v_2 \, Q \, v_1]$). A difficulty with the binary relation Q is that it is not necessarily

complete: one can thus conceive of vectors v_1 and v_2 such that $\varphi_1^* < \varphi_2^*$ and $\beta_1 > \beta_2$; v_1 and v_2 would then just not be comparable in terms of the relation Q.

To get around the problem of incompleteness of the binary relation Q in the absence of 'vector dominance' one could try and define a real-valued index α which is a function of the components of the vector v , with the property that α is increasing in each of its arguments, and with a higher value of α signifying a greater difficulty with which poverty can be eliminated through redistribution:

$$\alpha=\alpha(\varphi^*,\beta), \qquad \ldots(4)$$

$\alpha(\varphi_1^*,\beta) > \alpha(\varphi_2^*,\beta)$ whenever $\varphi_1^* > \varphi_2^*$, and $\alpha(\varphi^*,\beta_1) > \alpha(\varphi^*,\beta_2)$ whenever $\beta_1 > \beta_2$.

A particularly simple functional form for α, which we advance, is the multiplicative one:[1>]

$$\alpha(\varphi^*,\beta) = \varphi^*\beta. \qquad \ldots(5).$$

At this stage, a simple diagrammatic illustration may be of assistance. Figure 1 features the income distribution function before and after the redistribution exercise.

A typical cumulative density function would look like the curve OAB in Figure 1. After the redistribution, the incomes of all the erstwhile poor units are concentrated at z (the poverty line), while the incomes of the richest φ^* proportion of the population are concentrated at x^*: the post-distribution density function will therefore be represented by the curve OzCDEA. From Figure 1, we can see that there are two polar cases for the range of values that can be assumed by x^* - namely, $\bar{x}$ and z.

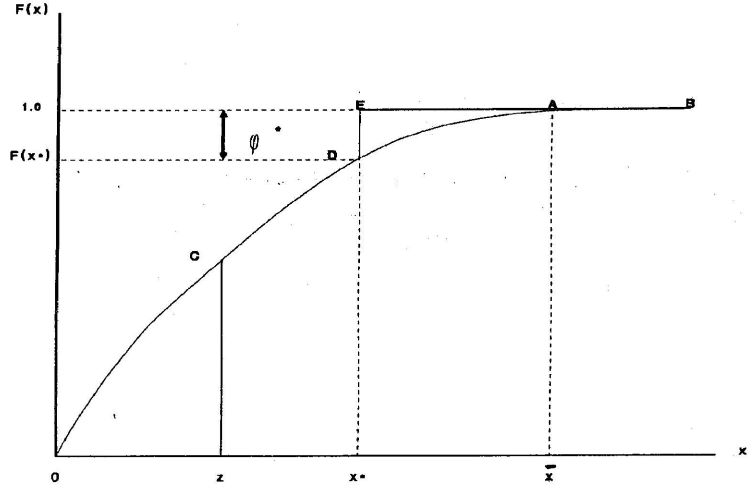

Figure 1: The cumulative density function for income - before and after implementing a progressive redistributive taxation schedule.

Note that as x^* goes to $\bar{x}$, φ^* goes to zero whence $\alpha(\varphi^*,\beta)$ goes to zero; and as x^* goes to z, both φ^* and β go to unity, whence $\alpha(\varphi^*,\beta)$ goes to unity. Thus, the ratio α has the convenient property of lying in the interval [0,1]: the closer it is to zero, the greater the potential for the eradication of poverty through the redistribution of income from progressive taxation of the richest of the rich.

It would be of some interest to obtain estimates of α from actual empirical distributions. This exercise is undertaken, using Indian data, in the following section.

4. SOME POVERTY-RELATED COMPUTATIONS FOR INDIA

Official statistics on the distribution of <u>consumption expenditure</u>, though not of income, are available for the Indian economy. The source of data is constituted by various rounds of the Central Statistical Organization's National Sample Surveys on the distribution of consumption expenditure across expenditure size-class: these data are available for selected years between 1960-61 and 1987-88 (we have not, in this paper, considered data for the 'fifties). In Tables 1 and 2, we have provided certain poverty-related statistics for rural and urban India respectively, for fifteen years, over the period 1960-61 to 1987-88. Details of data and methodology are provided in a brief appendix to this paper.

In Tables 1 and 2, for each of rural and urban India, and for each of the fifteen years for which we have data, we have presented the following information: the headcount ratio (column 2); the normalized aggregate poverty deficit D (column 3); the size of the total population[2] (column 4); the aggregate poverty deficit, which is obtained as the product of the normalized deficit and the size of the population (column 5); the richest φ^*

Table 1: Some Poverty-Related Statistics for Rural India (1960-61 - 1987-88)

(1) Year	(2) Headcount Ratio	(3) Normalized Aggregate Poverty Deficit (in rupees) (D)	(4) Population (in millions) (S)	(5) Aggregate Poverty Deficit (=DxS) (in millions of rupees)	(6) θ^*	(7) Consumption Level of the Least Rich of the Taxed Units (in rupees) (x^*)	(8) Normalized Aggregate Consumption of Richest θ^* Proportion of the Population (N)	(9) Aggregate Consumption of Richest θ^* Proportion of the Population (in millions of rupees) (=NxS)	(10) β (=D÷N)	(11) α (=$\theta^*\beta$)	(12) Mean Consumption of Poor Before Re-distribution (in rupees) (μ^P)	(13) Mean Consumption of Nonpoor Before Re-distribution (in rupees) (μ^N)	(14) Mean Consumption of Poor After Re-distribution (in rupees) (μ^{*P})	(15) Mean Consumption of Nonpoor After Re-distribution (in rupees) (μ^{*N})	(16) Ratio of Nonpoor to Poor Means Before Re-distribution ($\mu^N \div \mu^P$)	(17) Ratio of Nonpoor to Poor Means After Re-distribution ($\mu^{*N} \div \mu^{*P}$)
1960-61	0.3837	1.6045	360.20	577.94	0.0714	40.65	4.5054	1622.85	0.3561	0.0254	10.82	28.10	15.00	25.50	2.60	1.70
1961-62	0.3890	1.5988	367.40	587.40	0.0684	41.08	4.4076	1619.35	0.3627	0.0248	11.33	28.35	15.45	25.73	2.50	1.67
1963-64	0.4514	2.2186	382.24	848.04	0.1334	33.42	6.6755	2551.64	0.3323	0.0443	12.79	30.26	17.70	26.21	2.37	1.48
1964-65	0.4658	2.7910	389.88	1088.16	0.1453	37.99	8.3104	3240.06	0.3358	0.0489	15.46	36.02	21.45	30.79	2.33	1.44
1965-66	0.4951	3.3721	397.70	1341.08	0.1630	39.15	9.7522	3878.45	0.3458	0.0564	16.89	39.69	23.70	33.01	2.35	1.39
1966-67	0.5542	5.1168	405.66	2075.68	0.2951	35.05	15.4595	6271.30	0.3310	0.0977	19.27	45.36	28.50	33.88	2.35	1.19
1967-68	0.5312	5.0466	413.76	2088.08	0.2763	39.80	16.0434	6638.12	0.3146	0.0869	21.40	48.62	30.90	37.85	2.27	1.23
1968-69	0.5036	4.1069	422.05	1733.32	0.1557	46.56	11.3546	4792.21	0.3617	0.0563	19.59	47.18	27.75	38.91	2.41	1.40
1969-70	0.4861	4.5063	430.48	1939.87	0.2040	44.63	13.6103	5858.96	0.3311	0.0675	20.58	48.06	28.95	39.29	2.34	1.32
1970-71	0.4601	3.7031	439.05	1625.85	0.1678	48.90	11.9086	5228.47	0.3110	0.0522	20.75	47.72	28.80	40.86	2.30	1.42
1972-73	0.4367	3.9857	451.96	1801.38	0.1008	71.72	11.2121	5067.42	0.3555	0.0358	24.62	59.04	33.75	51.96	2.40	1.54
1973-74	0.4234	4.9777	458.54	2282.47	0.1620	76.78	17.4129	7984.51	0.2859	0.0463	30.69	71.11	42.45	62.48	2.32	1.47
1977-78	0.4126	5.0997	485.94	2478.15	0.0277	184.78	10.2359	4974.02	0.4982	0.0138	36.09	91.59	48.45	82.91	2.54	1.71
1983-84	0.3509	5.3917	530.07	2857.98	0.0484	222.21	16.1361	8553.26	0.3341	0.0166	62.93	139.22	78.30	130.91	2.21	1.67
1987-88	0.2467	4.9515	561.71	2781.13	0.0107	546.91	10.8243	6080.12	0.4574	0.0049	77.43	181.39	97.50	174.82	2.34	1.79

Table 2: Some Poverty-Related Statistics for Urban India (1960-61 - 1987-88)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Year	Headcount Ratio	Normalized Aggregate Poverty Deficit (in rupees) (D)	Population (in million (S)	Aggregate Poverty Deficit (=DxS) (in millions of rupees)	θ*	Consumption Level of the Least Rich of the Taxed Units (in rupees)	Normalized Aggregate Consumption of Richest θ* Proportion of the Population	Aggregate Consumption of Richest θ* Proportion of the Population (in millions of rupees) (=NxS)	β (=D÷N)	α (=θ*β)	Mean Consumption of Poor Before Re-distribution (in rupees) (μ^P)	Mean Consumption of Nonpoor Before Re-distribution (in rupees) (μ^N)	Mean Consumption of Poor After Re-distribution (in rupees) (μ^{*P})	Mean Consumption of Nonpoor After Re-distribution (in rupees) (μ^{*N})	Ratio of Nonpoor to Poor Means Before Re-distribution ($\mu^N \div \mu^P$)	Ratio of Nonpoor to Poor Means After Re-distribution ($\mu^{*N} \div \mu^{*P}$)
1960-61	0.4263	2.6903	78.94	212.37	0.0671	59.08	6.6519	525.10	0.4044	0.0271	14.49	40.69	20.80	36.00	2.81	1.73
1961-62	0.4157	2.7608	81.54	225.12	0.0620	63.79	6.7135	547.42	0.4112	0.0255	14.76	42.32	21.40	37.59	2.87	1.76
1963-64	0.4897	3.9334	86.99	342.17	0.0960	57.85	9.4854	825.13	0.4147	0.0398	16.97	48.31	25.00	40.60	2.85	1.62
1964-65	0.4819	4.1001	89.85	368.39	0.0921	63.29	9.9267	891.91	0.4130	0.0380	18.89	51.97	27.40	44.06	2.75	1.61
1965-66	0.5275	5.1535	92.81	478.30	0.1517	53.11	13.2078	1225.82	0.3902	0.0592	20.43	54.76	30.20	43.85	2.68	1.45
1966-67	0.5333	5.9522	95.86	570.58	0.1499	60.12	14.9625	1434.31	0.3978	0.0596	23.24	62.45	34.40	49.70	2.69	1.44
1967-68	0.4959	5.3972	99.01	534.38	0.1156	71.57	13.6691	1353.38	0.3948	0.0456	24.52	64.83	35.40	54.13	2.64	1.53
1968-69	0.4659	5.0279	102.27	514.20	0.1010	76.32	13.3971	1370.12	0.3753	0.0411	24.21	65.08	35.00	55.67	2.69	1.59
1969-70	0.4598	5.0377	105.64	532.18	0.0642	101.38	11.5470	1219.83	0.4363	0.0280	25.84	71.28	36.80	61.96	2.76	1.68
1970-71	0.4354	4.8548	109.11	529.71	0.0729	101.63	12.2590	1337.58	0.3960	0.0289	26.85	72.90	38.00	64.30	2.72	1.69
1972-73	0.4496	6.4890	117.45	762.13	0.0928	111.31	16.8140	1974.80	0.3859	0.0358	32.77	88.48	47.20	76.69	2.70	1.62
1973-74	0.5459	10.3280	121.85	1258.47	0.2099	88.15	28.8364	3513.72	0.3582	0.0752	41.88	102.68	60.80	79.94	2.45	1.31
1977-78	0.3975	7.4602	141.18	1053.23	0.0504	210.80	18.0377	2552.21	0.4127	0.0208	47.03	128.56	65.80	116.17	2.73	1.77
1983-84	0.3454	9.5127	176.08	1675.00	0.0360	397.43	23.3441	4198.47	0.3990	0.0144	78.86	208.97	106.40	194.44	2.65	1.83
1987-88	0.3743	16.3586	204.02	3337.48	0.0344	646.04	38.4821	7851.12	0.4251	0.0146	117.49	329.16	161.20	303.01	2.80	1.88

proportion of the population that would be affected by implementation of a progressive redistributive tax schedule (column 6); the consumption level x^* of the worst-off of the units that would be taxed (column 7); the normalized aggregate consumption N of the richest φ^* proportion of the population (column 8), and the total value of such consumption, obtained as a product of N and the population size (column 9); the value of β, viz. the ratio of the aggregate poverty deficit to the consumption of the richest φ^*proportion of the population (column 10); the value of the index α, which is simply the product of φ^* and β (column 11); the mean consumption level of the poor and the nonpoor, both before and after the redistribution (columns 12-15); and the ratio of the mean consumption of the nonpoor to that of the poor, both before and after the redistribution (columns 16 and 17).

The figures presented in Tables 1 and 2 are largely self-explanatory, so we shall confine ourselves to a quick commentary on the salient features of the numbers in the tables. First, one may note that there is a close association between the head count ratio and the α ratio: if we rank the years for which we have observations, according to both the head count ratio and the α ratio, then Spearman's rank correlation coefficient for the two sets of rankings emerges at the fairly high levels of 0.95 and 0.975 for rural and urban India respectively. Of course, in <u>strict</u> logic, one need not suppose that poverty and the relative ease with which it can be alleviated through redistribution are <u>necessarily</u> closely associated (indeed, Sen (1981), is for this reason opposed to interpreting an index such as P, discussed in Section 1 of this note, as an index of <u>poverty</u> <u>per</u> <u>se</u> rather than as an index of the 'relative burden' of poverty); however, the empirical evidence for India suggests - and this is unsurprising - that there <u>is</u> such a close relationship. Second, the time-trend in α suggests that for both the rural and urban areas of the country, α first rises

through the 'sixties upto the mid - 'seventies, and then declines. Third, if the difficulty of alleviating poverty through progressive redistributive taxation is reckoned on a scale going from zero to one hundred per cent (which is, precisely, the α ratio expressed in per cent terms), then even in the worst year in rural (respectively, urban) India, this ratio was less than 10 per cent (respectively, 8 per cent); the simple average of the α values , over our 15-year series of observations, is only around 4.5 per cent for the rural areas, and around 3.7 per cent for the urban areas. Fourth - and this is a related point - it has often been claimed that a move toward implementation of some egalitarian measure for the alleviation of poverty would only succeed in 'redistributing poverty': the last column in each of Tables 1 and 2 suggests that this is a misconceived view. The simple average of the 15-year series of observations we have on the post-redistribution ratio of the nonpoor mean consumption to the poor mean consumption is as high as 1.49 for the rual areas and 1.63 for the urban areas; in 1966-67 and 1967-68 this ratio is relatively low for rural India - but despite the effect of severe drought conditions in the mid- to late 'sixties, it is worth noting that the average consumption of the nonpoor has exceeded that of the poor by a factor of at least around 120 per cent (the lowest value which this ratio has attained, in urban India, is even higher, at around 131 per cent, in 1973-74).

It is worth noting that we have dealt only with 'flows' (consumption expenditure) and not with 'stocks' (assets, including land). There is, surely, a case for some redistribution of endowments as a measure of poverty-redressal in an economy such as India's which is characterized by enormous inequities in the distribution of land and other assets. In this connection, Nripen Bandopadhyay's (1988) comprehensive assessment of the essentially un-serious engagement of the Indian state with land-reform measures

is instructive. Further, the agricultural sector has remained virtually untapped as a large potential source of income- and wealth- taxation. K.N. Raj (1973) strongly endorsed the scheme of progressive direct agricultural income taxation proposed by a Committee on Agricultural Wealth and Income constituted in the early 'seventies; and he expressed the keen expectation that the committee's proposals would be accepted by the planners during the Fifth Plan period. This, of course, did not happen, and the whole issue of agricultural income taxation has since been pushed into the background. While on the subject of direct taxation it is also pertinent to point out that avoidance of corporate taxation - by resort to what is called 'corporate tax planning'- is a fairly routine aspect of the functioning of the private corporate sector in India.

Finally, it must be emphasized that we have dealt with consumption, not income, data: given that the marginal propensity to consume out of income is much higher for the poorer than the richer classes, the values of α, if computed on the income dimension, are likely to be even smaller than those reported in Tables 1 and 2 for consumption data. Furthermore, we have not thus far taken account of the large 'parallel' sector which is so integral a feature of the Indian economic regime. According to a report submitted to the Ministry of Finance by the National Institute of Public Finance and Policy (1986), a very conservative estimate of the unaccounted income generated in the Indian economy in 1983-84 was 18 per cent of GDP at factor cost (or Rs.315,840 millions at current prices). From Tables 1 and 2, it can be noted that the combined rural-and-urban aggregate poverty deficit (on a monthly basis) was of the order of Rs.4533 millions, or Rs.54,396 millions on an annual basis (=Rs.4533 millions x 12 months): this poverty deficit is just a little over 17 per cent of the unaccounted income in 1983-84! Again, according to estimates

provided in a recent report on taxation in India (the Chelliah Committee Report[3]), tax revenue to the extent of Rs.250,000 millions can be raised given a disclosure rate of 60 per cent and an average tax rate of 20 per cent: this suggests that the base of taxable income is roughly Rs.2100,000 millions [≈ 250,000/(.6 x .2)]. In 1987-88, the combined rural-and-urban aggregate poverty deficit (see Tables 1 and 2) was of the order of around Rs.73,424 millions; adding this incremental amount needed to eradicate poverty in the economy to the Chelliah Committee Report's suggested feasible revenue collection of Rs.250,000 millions, yields an annual desired tax revenue of around Rs.323,424 millions. This can be achieved, preserving an average tax rate of 20 per cent, by raising the disclosure rate to 77 per cent; or, preserving the disclosure rate at 60 per cent, by raising the average tax rate to 26 per cent.[4] These calculations, while they are very rough and ready and lay no claim to refined accuracy, do nevertheless convey significant orders of magnitude; and the measures we have discussed, based on these calculations, do not appear to be beyond the bounds of practical politics - at any rate of a politics that has the necessary will.

Redistribution of assets; land reforms; taxation of the agricultural sector; a serious-minded attack on a rapidly expanding parallel economy; progressive taxation: these would appear to be some essential ingredients of what one might have in mind when conceptualizing 'structural reform' in the alleviation of poverty and the acceleration of development. In this context, a great deal of what passes for 'structural adjustment' and 'reform' in a Bank-Fund sponsored regime of economic policy-making for countries like India - with its all-but-exclusive emphasis on 'liberalization', 'deregulation', 'incentives' and 'getting prices right' - must be judged to amount to the forsaking of more urgent remedial measures for altogether less directly relevant ones.

5. CONCLUDING OBSERVATIONS

In this note, we have presented a very elementary index which measures the relative ease with which poverty in an economy can be eradicated through a scheme of progressive redistributive taxation. Certain straightforward poverty computations, relating to the theme of this paper, have been performed for the Indian economy. Our empirical exercises confirm (if confirmation were needed) that India has a serious problem of poverty, from the perspective that so much of it is in evidence (in 1987-88, the last year for which we have data, about 28 per cent of the population were in poverty); yet, from another perspective, the problem of poverty would appear to be less than serious, in that the potential capacity for eradicating poverty through redistributive taxation is very encouraging: the α index, which measures the difficulty of so eradicating poverty on a scale going from zero to one hundred per cent, was less than 1.5 per cent for India in 1987-88. The cure for poverty is simple, but its implementation - judging from the state's reluctance to perturb the settled weight of vested interests - is clearly far from easy. What Sen(1981) says of famine starvation would appear to apply more generally to the phenomenon of poverty: that it is not so much a problem of there not being enough income to go around as of some people not having enough of it to escape deprivation. This is asserted here not because it is not well known, but because - through a strategem of indirection and emphasis on irrelevancies - it appears to have become fashionable to ignore it in the framing of developmental goals and the formulation of economic policy.

APPENDIX

Data and Methodology

A basic step in the computation of the head count ratio and related poverty statistics is the estimation of the Lorenz curve, which plots the graph of the function q(p) - the cumulative share in total consumer expenditure of the poorest pth fraction of expenditure units. To estimate the equation of the Lorenz curve, then, one requires data on the ordinates p and q of the curve; and such grouped data are available in the National Sample Survey Reports on the distribution of monthly per capita consumer expenditure across expenditure size-classes. The present study has made use of the following Rounds of the NSS data ('Tables with Notes on Consumer Expenditure'):

1960-61	:	Report No.136, Sixteenth Round;
1961-62	:	Report No.184, Seventeenth Round;
1963-64	:	Report No.142, Eighteenth Round;
1964-65	:	Report No.192; Nineteenth Round;
1965-66	:	Report No.209, Twentieth Round;
1966-67	:	Report No.230, Twenty-first Round;
1967-68	:	Report No.216, Twenty-second Round;
1968-69	:	Report No.228, Twenty-third Round;
1969-70	:	Report No.235, Twenty-fourth Round;
1970-71	:	Report No.231, Twenty-fifth Round;
1972-73	:	<u>Sarvekshana</u>, Vol II, No.3, January 1979; Twenty-seventh Round;
1973-74	:	Report No.240, Twenty-eighth Round;
1977-78	:	Report No.311, Thirty-second Round;
1983	:	Report No.319, Thirty-eighth Round;
1987-88	:	<u>Sarvekshana</u>, Vol XV, No.1, July-September 1991; Forty-third Round.

One's estimate of the head count ratio will depend on the poverty line one employs, the price deflator one chooses in order to express the base-year poverty line at current prices, and the mean of the distribution one uses in one's computations. In this

study, we have employed, for rural India, a poverty line of Rs.15 per capita per month at 1960-61 prices (a line which has enjoyed some vogue in the Indian poverty literature); the price deflator employed is the Consumer Price Index of Agricultural Labourers (CPIAL); and the estimate of mean consumption used in poverty calculations is that afforded by the NSS's data on the distribution of consumption expenditure across expenditure size-classes. For urban India, the poverty line has been taken to be a consumer expenditure level of Rs.20.80 per capita per month at 1960-61 prices (obtained as a product of a postulated poverty line of Rs.20 per person per month at 1959-1960 prices and the relevant index number of prices, 1.04, for 1960-61; the twenty-rupee poverty line is a conservative scaling down of a poverty line of Rs.22.60 derived by V.M. Dandekar and N.Rath (1980): Poverty in India, Indian School of Political Economy: Poona). The price deflator employed for the urban areas is the Consumer Price Index of Industrial Workers (CPIIW), and estimates of the mean consumption are afforded, again, by the NSS consumption data.

Table A1 presents information on the Consumer Price Indices for Agricultural Labourers and Industrial Workers for the reference years of this study. It should be noted that (i) the CPIAL figures for 1961-62 and 1963-64 are from Ahluwalia (1978), and (ii) we have taken the CPIIW for 1961 as pertaining to the year 1960-61, and so on; for the rest, data on the price indices are from the publication The Indian Labour Journal. Using the norms for the rural and urban poverty lines discussed above, and the relevant price indices, the poverty lines at current prices can be obtained, and are also presented in Table A1. Insofar as estimates of the mean consumption expenditure are concerned, these are directly available from the NSS reports on consumer expenditure; for some years, however, data on 'the percentage

distribution of estimated number of persons by monthly per capita expenditure classes' are not directly available, and have had to be calculated from data on 'the percentage distribution of estimated number of households by monthly per capita expenditure classes' in conjunction with data on the estimated number of persons per household: in these cases, there is some discrepancy between the mean as reported by the NSS and the mean which is consistent with the calculated 'percentage distribution of estimated number of persons by monthly per capita expenditure classes', and we have employed the latter mean rather than the reported mean. In Table A1, estimates of consumption means, separately for the rural and the urban areas, are available for the reference years of this study.

Table A1: Price Indices, Poverty Lines at Current Prices, and Mean Consumption at Current Prices for Rural and Urban India (1960-61-1987-88)

Year	Price Indices		Poverty lines at current prices (rupees/person/month)		Mean Consumption Expenditure at current prices (rupees)	
	CPIAL	CPIIW	Rural	Urban	Rural	Urban
1960-61	100	104	15.00	20.80	21.47	29.52
1961-62	103	107	15.45	21.40	21.73	30.86
1963-64	118	125	17.70	25.00	22.37	32.96
1964-65	143	137	21.45	27.40	26.44	36.03
1965-66	158	151	23.70	30.20	28.40	35.65
1966-67	190	172	28.50	34.40	30.90	41.54
1967-68	206	177	30.90	35.40	34.16	44.84
1968-69	185	175	27.75	35.00	33.29	46.04
1969-70	193	184	28.95	36.80	34.70	50.39
1970-71	192	190	28.80	38.00	35.31	52.85
1972-73	225	236	33.75	47.20	44.01	63.43
1973-74	283	304	42.45	60.80	54.00	69.49
1977-78	323	329	48.45	65.80	68.69	96.15
1983-84	522	532	78.30	106.40	112.45	164.03
1987-88	650	775	97.50	161.20	155.75	249.93

We turn next to some more directly computational issues. At any point on the Lorenz curve corresponding to an expenditure level x, the slope of the curve is given by $q'(p(x)) = x/\mu$, where μ is the mean of the distribution (Kakwani, 1980). If z is the poverty line, and if the equation of the Lorenz curve is known, then it is possible to compute the head count ratio p(z) by solving for p(.) in the equation

$$q'(p(z)) = z/\mu. \qquad \text{...(A1)}$$

The procedure employed in this study to estimate the equation of the Lorenz curve is due to Kakwani (1981), and is briefly described below. Let the function s(p) be defined by: s(p) := p-q(p). It is clear that when p is zero, s(p) is zero and when p is unity, s(p) is again zero. Thus, s(p) is a double-valued function of p, which peaks at a value of p greater than, equal to, or less than one-half depending on whether the Lorenz curve is skewed toward (0,0), is symmetric, or is skewed toward (1,1) of the unit square. Kakwani (1981) suggests that a good estimating equation for the function s(p) would be given by $s(p) = bp^{\delta}(1-p)^{\sigma}$ - with $b,\delta,\sigma \in [0,1]$ - which can be estimated by the method of ordinary least squares in log-linear form. From the grouped observations on q and p afforded by the NSS data, the parameters b,δ and σ have been estimated for the reference years of this study, separately for the rural and urban areas, and are presented in Table A2. Recalling the definition of the function s(p), it is clear that the estimated equation of the Lorenz curve is given by:

$$q(p) = p-bp^{\delta}(1-p)^{\sigma}. \qquad \text{...(A2)}$$

Table A2: <u>Ordinary Least Squares Estimates of the Paremeters in the Equation of the Function $s(p) = bp^{\delta}(1-p)^{\sigma}$.</u>

Year	Rural India			Urban India		
	b	δ	σ	b	δ	σ
1960 - 61	0.6054	0.9388	0.5324	0.6391	0.9458	0.4922
1961 - 62	0.5821	0.9363	0.5214	0.6393	0.9336	0.4866
1963 - 64	0.5631	0.9338	0.5428	0.6499	0.9576	0.4794
1964 - 65	0.5441	0.9174	0.5313	0.6250	0.9456	0.4756
1965 - 66	0.5464	0.9189	0.5207	0.6226	0.9517	0.4965
1966 - 67	0.5781	0.9298	0.5822	0.6158	0.9445	0.4852
1967 - 68	0.5547	0.9212	0.5879	0.6083	0.9436	0.4873
1968 - 69	0.5521	0.9149	0.5034	0.6324	0.9541	0.5146
1969 - 70	0.5546	0.9244	0.5470	0.6181	0.9434	0.4581
1970 - 71	0.5554	0.9320	0.5690	0.6298	0.9549	0.4977
1972 - 73	0.5535	0.9189	0.5149	0.6246	0.9449	0.5029
1973 - 74	0.5722	0.9391	0.6072	0.5833	0.9477	0.5265
1977 - 78	0.5462	0.9107	0.4127	0.6174	0.9385	0.4859
1983 - 84	0.5614	0.9280	0.5432	0.6050	0.9427	0.5045
1987 - 88	0.4975	0.8973	0.4691	0.6413	0.9616	0.4875

Given (A1) and (A2) it is now a simple matter to see that the head count ratio is obtained by solving (heuristically) for p(z) in the equation

$$b(p(z))^{\delta}\ (1-p(z))^{\sigma}\ \{(\delta/p(z))-(\sigma/(1-p(z))\} = 1-z/\mu. \qquad \ldots(A3)$$

Further, the normalized aggregate poverty deficit D is given by

$D = zp(z)-q(p(z))\mu$, or, substituting for q(.) from (A2), by:

$$D = zp(z)-\{p(z)-b(p(z))^{\delta}(1-p(z))^{\sigma}\}\mu.$$

Next, note from equation (2) in the text that the income level x^* satisfies $\int_{x^*}^{x}(x-x^*)f(x)dx = D$, or equivalently - as can be easily shown:

$$\mu[1-q(p(x^*))] -x^*[1-p(x^*)] = D. \qquad \ldots(A5)$$

Substituting for q(.) from (A2) and for x^* from the relationship $q'(p(x^*)) = x^*/\mu$, and writing q^* and p^* respectively for $q(p(x^*))$ and $p(x^*)$, enable us to rewrite (A5), after suitable simplification, as:

$$bp^{*\delta}(1-p^*)^{\sigma}\ [(1-p^*)\{(\delta/p^*)-(\sigma/(1-p^*))\}+1] = D. \qquad \ldots(A6)$$

Solving for p^* then paves the way routinely for the computation of φ^* $(=1-p^*)$; x^* (which is obtained, given (A5), as $x^* = \mu(1-q^*)/D(1-p^*))$; N $(=\mu(1-q^*))$; β (=D/N); and α $(= \varphi^*\beta)$.

Finally, note that $\mu^P = \{q(z)/p(z)\}\mu$, $\mu^N = \{(1-q(z)\}/(1-p(z))\}\mu$, $\hat{\mu}^P = z$, and $\hat{\mu}^N = (\mu-zp(z))/(1-p(z))$.

NOTES

1. The multiplicative form is essentially arbitrary, but it can be justified in terms of a set of axioms advanced and discussed, in the context of the 'normalization axiom' associated with Sen's (1976) poverty index, by Kaushik Basu (1985). Notice first that since $\varphi^{*}\in[0,1]$ and $\beta\in[0,1]$, the ratio α can be written as a function $\alpha:[0,1]\times[0,1]\longrightarrow \mathbb{R}$. The following restrictions on α, presented in the form of a set of 'reasonable' properties one may expect α to satisfy, are borrowed from Basu (1985):

<u>Axiom</u> <u>1(a).</u> $\alpha(1,1)=1$.

<u>Axiom</u> <u>1(b).</u> $\lim_{\varphi^{*}\longrightarrow 0} \alpha(\varphi^{*},\beta) = \lim_{\beta\longrightarrow 0} \alpha(\varphi^{*},\beta) = 0.$

<u>Axiom</u> <u>2.</u> $\forall\varphi_1^{*},\varphi_2^{*},\varphi_3^{*},\varphi_4^{*}\in[0,1]$ & $\forall\beta\in[0,1]$:

$$[\varphi_1^{*}-\varphi_2^{*} >(=) \varphi_3^{*}-\varphi_4^{*}] \longrightarrow [\alpha(\varphi_1^{*},\beta)-\alpha(\varphi_2^{*},\beta) >(=) \alpha(\varphi_3^{*},\beta)-\alpha(\varphi_4^{*},\beta)].$$

<u>Axiom</u> <u>3.</u> $\forall\beta_1,\beta_2,\beta_3,\beta_4\in[0,1]$ & $\forall\varphi^{*}\in[0,1]$:

$$[\beta_1-\beta_2 >(=) \beta_3-\beta_4] \longrightarrow [\alpha(\varphi^{*},\beta_1^{*})-\alpha(\varphi^{*},\beta_2^{*}) >(=) \alpha(\varphi^{*},\beta_3)-\alpha(\varphi^{*},\beta_4)].$$

It can be shown that the only functional form for α which satisfies Axioms 1(a), 1(b), 2 and 3, is given by $\alpha(\varphi^{*},\beta) = \varphi^{*}\beta$: the proof of this proposition follows almost exactly along the lines of the proof of Theorem 1 in Basu (1985). We shall not pursue the point any further: this footnote has been intended only in the spirit of a footnote, since our primary concern is not with an excessive regard for formalities.

2. Sectoral population estimates for the reference years of this study have been obtained by employing the growth rates relevant for the 1960-61 - 1970-71 decade to project population figures for the years in this intercensal period, and the growth rates relevant for the 1970-71 - 1980-81 decade to project population figures for the years after 1970-71.

3. Report of the Tax Reform Committe chaired by Professor Rajah J.Chelliah, Government of India: Department of Revenue, 1992.

4. We are grateful to S.Guhan and K. Nagaraj for pointing to the relevance of these calculations.

5. This appendix draws considerably on the 'Appendix' in Subramanian (1990).

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